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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/828,441	04/20/2004	Li-Qun Xia	AMAT/6392.C1/DSM/LOW K/JW	4006
44257	7590	05/20/2005	EXAMINER	
MOSER, PATTERSON & SHERIDAN, LLP APPLIED MATERIALS, INC. 3040 POST OAK BOULEVARD, SUITE 1500 HOUSTON, TX 77056			NGUYEN, HA T	
			ART UNIT	PAPER NUMBER
			2812	

DATE MAILED: 05/20/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

H.A

Office Action Summary

Application No.

10/828,441

Applicant(s)

XIA ET AL.

Examiner

Ha T. Nguyen

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 28 March 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 26-28,30,35-39,41 and 46-55 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 26-28,30,35-39,41 and 46-55 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Notice to applicant

1. Applicants' Amendment and Response to the Office Action mailed 01-04-2005 has been entered and made of record.

Claim Rejections - 35 USC 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103 and potential 35 U.S.C. 102(f) or (g) prior art under 35 U.S.C. 103(a).

3. Claims 26-28, 30, 35-37, 39, and 41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chooi et al. (USPN 6436824, hereinafter "Chooi") in view of Xia et al. (EP 1050601, hereinafter "Xia").

Referring to Figs. 1-3 and related text, Chooi discloses [Re claims 26-27] a method for depositing a silicon carbide layer on a substrate, comprising: introducing a processing gas comprising an organosilicon compound into a processing chamber containing the substrate therein, wherein the organosilicon compound consists essentially of silicon, carbon, and hydrogen, and has a carbon atom to silicon atom ratio of 6:1 or greater; and reacting the organosilicon compound to form the silicon carbide layer 16 having a dielectric constant in the

range of 3-6.5; wherein the substrate comprises metal features 14 and the barrier layer is formed thereon; [Re claims 35-37] a method for processing a substrate having metal 14 therein, comprising: formed depositing a barrier layer 16 on the substrate on the metal features by introducing a processing gas comprising an organosilicon compound into a processing chamber containing the substrate therein, wherein the organosilicon compound consists essentially of silicon, carbon, and hydrogen, and has a carbon atom to silicon atom ratio of about 6:1 or greater and the barrier layer has a dielectric constant in the range of 3-6.5; and depositing a first dielectric layer adjacent the barrier layer, wherein the first dielectric layer 18 comprises silicon, oxygen, and carbon and has a dielectric constant of about 3 or less ; depositing a silicon carbide etch stop 20 on the first dielectric layer (see col. 3, line 45-col. 5, line 10). But it fails to disclose expressly the claimed ranges and the use of a dopant compound and the details about the dopant compound. However, Xia discloses this feature (see par. 72). Besides, in the case where the claimed ranges “overlap or lie inside ranges disclosed by the prior art” a *prima facie* case of obviousness exists (See MPEP 2144.05). At the time of the invention, an ordinary artisan is motivated to combine Chooi with Xia to reduce metal contamination (see par. 72).

[Re claims 28 and 39] Xia also discloses exposing the silicon carbide layer to a plasma treatment process (see par. 79); and

[Re claims 30 and 41] wherein the dopant compound selected from the group consisting of an oxygen-containing compound, a nitrogen-containing compound, a boron-containing compound, a phosphorus-containing compound, and combinations thereof (see par. 72).

Therefore, it would have been obvious to combine Chooi with Xia to obtain the invention as specified in claims 26-28, 30, 35-37, 39, and 41.

4. Claims 51-52 and 54-56 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chooi in view of Yang et al. (USPN 6365527, hereinafter “Yang”).

[Re claim 51] Chooi discloses a method for depositing a silicon carbide layer on a substrate, comprising: introducing a processing gas comprising an organosilicon compound that consists essentially of silicon, carbon, and hydrogen, and has a carbon atom to silicon atom ratio of 6:1 or greater to deposit the silicon carbide layer on the substrate; reacting the organosilicon compound to deposit the silicon carbide layer on the substrate (as shown above). But it fails to

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discloses wherein the silicon carbide layer comprises less than about 15 atomic percent of oxygen and exposing the deposited silicon carbide layer to a plasma treatment process. However, the missing limitations are well known in the art because Yang discloses these features (col. 3, lines 34-45). At the time of the invention, an ordinary artisan is motivated to combine Chooi with Yang to reduce oxygen content in the silicon carbide for use in oxygen-sensitive process.

[Re claim 54] Chooi discloses that wherein the silicon carbide layer has a dielectric constant of less than 4 (see col. 4, lines 1-29);

[Re claim 55] wherein the silicon carbide layer is deposited in a damascene structure as a material layer selected from the group consisting of a silicon carbide-containing barrier layer and a silicon carbide-containing etch stop layer (see Fig. 2); and

[Re claim 56] depositing a dielectric layer 22 adjacent the silicon carbide layer.

Therefore, it would have been obvious to combine Chooi with Yang to obtain the invention as specified in claims 51-52 and 54-56.

5: Claim 53 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chooi, in view of Yang, as applied to claims 51-52 and 54-56 above, and further in view of Xia.

The combined teaching of Chooi and Yang discloses substantially the limitations of claim 53, as shown above.

But it fails to disclose expressly wherein the processing gas further comprises a dopant selected from the group consisting of a boron-containing compound, a phosphorus-containing compound, phosphine (PH₃), borane (BH₃), diborane (B₂H₆), silazane compounds, oxygen (O₂), ozone (O₃), carbon monoxide (CO), carbon dioxide (CO₂), and combinations thereof.

However, the missing limitation is well known in the art because Xia discloses this feature, as shown above.

Therefore, at the time of the invention, it would have been obvious to combine Chooi and Yang with Xia to obtain the invention as specified in claim 53.

Double Patenting Rejection

6. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or

improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

Claims 46, 48, and 50 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1, 7, and 1, respectively of U.S. Patent No. 6759327. Although the conflicting claims are not identical, they are not patentably distinct from each other because the claims in the patent contain all the limitations of the instant claims.

Claims 47-50 variously depend from claim 46, they are rejected for the same reason.

Allowable Subject Matter

7. Claims 46-50 would be allowed if a Terminal Disclaimer is filed to overcome the double patenting rejection.

Claim 46 recites wherein the organosilicon compound has the formula $\text{SiHa}(\text{CH}_3)_b(\text{C}_6\text{H}_5)_c$, wherein c is 2 and $a+b+c=4$.

This features in combination with the other elements of the claim is neither disclosed nor suggested by the prior art of record.

Claims 47-50 variously depend from claim 46, they are allowed for the same reason.

Response to Amendment

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8. In view of applicants' cancellation of the claims, the rejections of claims 29, 31-34, 38, 40, 42-45 under 35 U.S.C. 103 are rendered moot.

In view of applicants' amendment to the claims, the rejections of claims 26-28, 30, 35-39, and 41 under 35 U.S.C. 103, as stated in the indicated Office Action, have been withdrawn.

In view of the new ground of rejection, applicants' arguments have been rendered moot.

Conclusion

9. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP, 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for response to this final action is set to expire **THREE MONTHS** from the date of this action. In the event a first response is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event will the statutory period for response expire later than **SIX MONTHS** from the date of this final action.

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ha T. Nguyen whose telephone number is (571) 272-1678. The examiner can normally be reached on Monday-Friday from 8:30AM to 6:00PM, except the first Friday of each bi-week. The telephone number for Wednesday is (703) 560-0528.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael S. Lebentritt, can be reached on (571) 272-1873. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR

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system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



HA NGUYEN
PRIMARY EXAMINER

5- 16- 05